STUDIES IN INTESTINAL EXCLUSION.*

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THESE studies were prompted by an operation upon a patient of one of the writers in whom, in order to reëstablish the continuity of the large intestine after the resection of the sigmoid flexure, an unusual anastomosis was employed.

The patient, a man fifty-six years of age, was operated on June 11th, 1906, for intestinal obstruction caused by what was supposed to be carcinoma of the sigmoid flexure but was afterwards proven to be hyperplastic tuberculosis. At operation the entire sigmoid flexure was found to be implicated in a mass which also invaded the bladder and the left spermatic cord. In order to remove it, it was necessary to sacrifice a portion of the descending and the upper part of the pelvic colon. The hiatus was so great that the ends could not be brought together without exerting undue tension, consequently the upper end of the remaining portion of the pelvic colon was implanted into the side of the middle of the transverse colon. This resulted in the formation of a blind pouch or cecum distal to the anastomosis (Fig. 1). The arrangement may be termed a unilateral aboral exclusion. It was recognized at the time to be faulty but the patient's condition precluded further interference and there was no certainty that it would provoke serious trouble.

The immediate convalescence from the operation was perfectly smooth and the patient gained twenty-eight pounds in the following two months. During this time he complained at times of colicky pains and there seemed to be accumulations of gas

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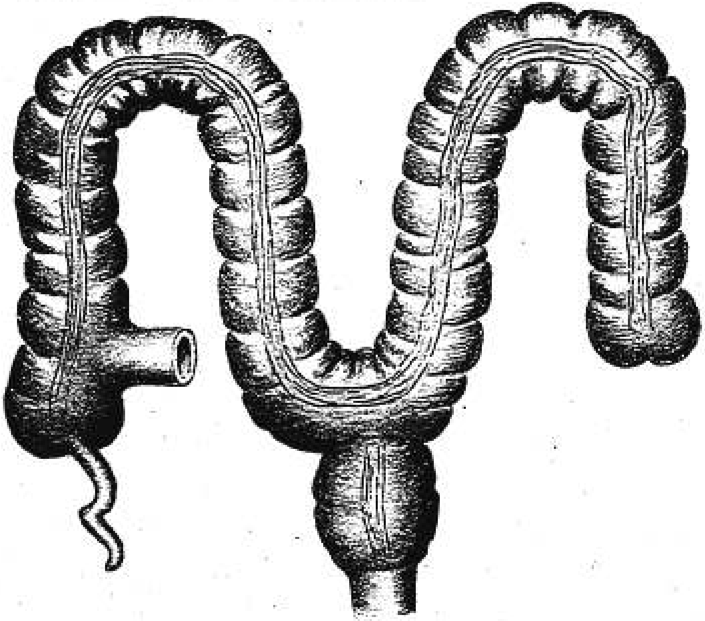
* This and the eight accompanying papers by Drs. Eggers, Greene, Leggett, Maury, Blake, and Beer represent the results of studies conducted during the session 1906–07, in the Laboratory for Surgical Research, College of Physicians and Surgeons, Columbia University.

FIG. 1.



Implantation of oral end of remaining portion of pelvic colon into side of transverse colon. The portion of the colon distal to the anastomosis is aborally excluded.

and fecal matter in the excluded loop. This could be relieved by irrigations with a long rectal tube. Excision and division of the loop were considered but were not advised on account of the

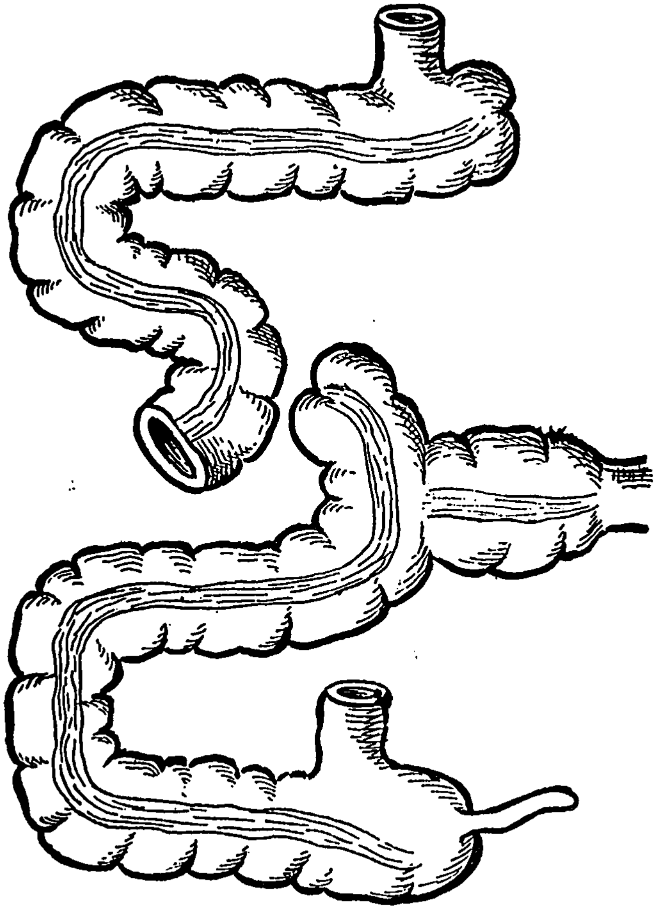


FIG. 2.—Showing arrangement after division of aboral segment and closure of proximal end. The totally excluded loop now communicates with the exterior at both ends; the distal opening being the one formed by spontaneous rupture.

continued improvement of the patient. In the meantime, he went to his home in a neighboring city and resumed his business.

During the winter the trouble from accumulation in the blind end increased necessitating daily irrigations and finally, at the end of January, 1907, perforation at the blind end occurred with the formation of an abscess. This was opened at Atlantic City. After remaining there for some weeks, he was brought to New York with a narrow sinus discharging pus, gas and fecal matter. The discharge occurred more or less intermittently and at times would be accompanied by sharp colicky pain due to the peristaltic efforts of the loop to empty itself. The patient's general condition was bad, he had lost much weight and was running a low grade septic fever. By increasing the drainage his condition was improved and on April 15, 1907, ten months after the first operation, the transverse colon was divided just distal to the anastomosis with the pelvic colon, the proximal end was closed and the distal end brought up into the incision (Fig. 2). The operation was exceedingly difficult on account of the adhesions. The loop now is a bilateral exclusion with a proximal opening; the distal end communicating with the skin by the fistulous tract. Water injected into the proximal end, escapes at once from the fistula but when injected into the fistula it does not escape from the proximal end, showing that it does not readily pass against peristalsis. Four months after the operation, the sinus communicating with the proximal end of the excluded loop barely admits a No. 12 French catheter and there is no discharge from it. The distal end is also open and communicates with a fistulous tract leading to the point where the intestine was closed just beyond the anastomosis. The discharge being mingled with a small amount of feces escaping from the latter its character and amount cannot be determined. However, as far as can be ascertained, the excluded loop has contracted so that it will hold only about an ounce of fluid.

The necessity for anastomosing the pelvic into the transverse colon seldom occurs. An extended search of the rather voluminous literature of intestinal anastomosis and exclusion failed to reveal a similar instance. As a rule, obstructing growths of the sigmoid flexure do not involve an extent so great as not to permit of end to end union after resection. Not having data derived from former cases and anticipating

Fig. 3.

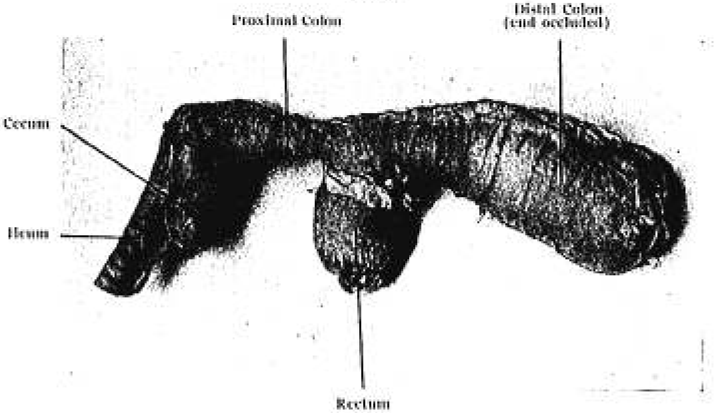
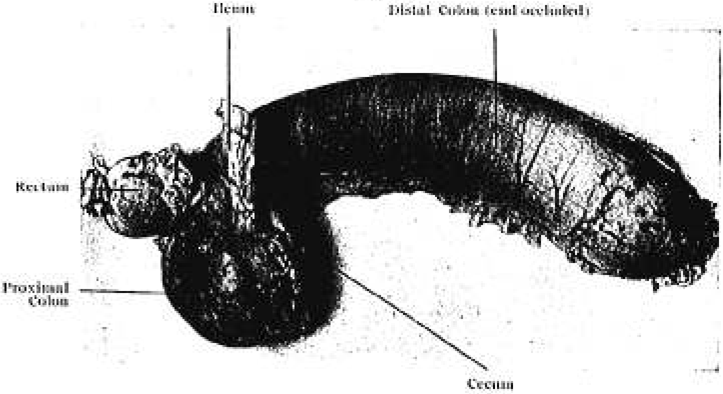
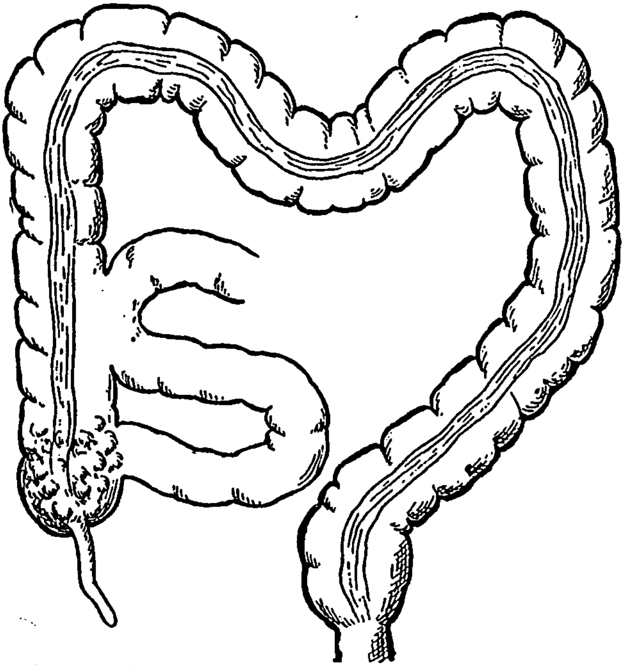

Proximal Colon
Distal Colon
(end occluded)
Cecum
Ileum
Rectum

Fig. 4.


Ileum
Distal Colon (end occluded)
Rectum
Proximal
Colon
Cecum

trouble from accumulation in the distal blind segment, similar operations were performed on dogs, the large intestine being divided just above the rectum, the oral end completely closed and the aboral end united end to side to the large intestine just distal to the ileocecal junction. The first dog was operated on November 19, 1906, and no adverse symptoms, excepting a temporary diarrhœa, being noted, the operation was repeated on another on February 7, 1907. This dog also suffered from diarrhœa for several weeks after the operation. On April 27, 1907, both dogs were killed.

FIG. 5.



Lateral anastomosis between the ileum and ascending colon, for the purpose of shunting the intestinal contents by an obstruction in the cecum.

Examination of the blind intestine beyond the anastomosis showed that the intestinal contents had been crowded toward the closed end dilating it to more than twice its normal diameter. Just beyond the anastomosis the diameter was practically normal which increased from there on to its maximum at the blind extremity (Figs. 3 and 4). After a greater lapse of time it is probable that perforation would have occurred in the dogs as it did in the man, either from ulceration or penetration by some foreign body accidentally ingested.

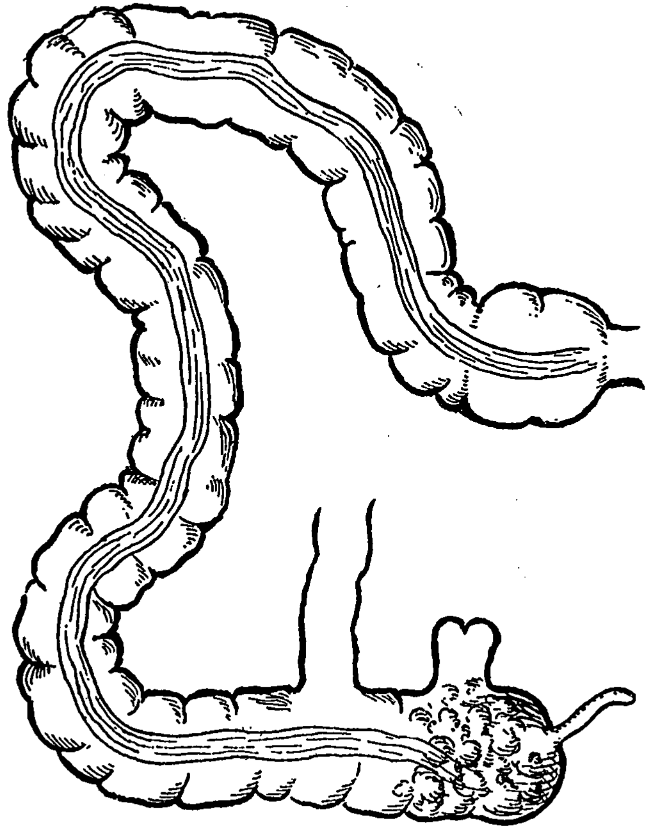
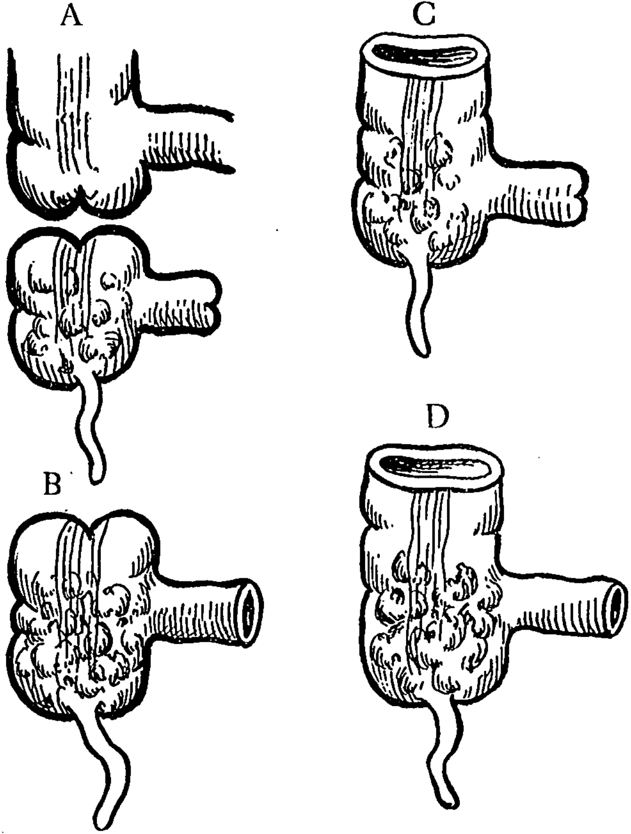


FIG. 6.—End to side implantation of ileum into ascending colon with occlusion of distal end of ileum. The segment comprising the distal portion of the ileum and the cecum is unilaterally or incompletely excluded and is unilaterally occluded.

The results of the operation upon the patient and the dogs show that aboral partial exclusion of the intestine is a faulty and dangerous procedure. If the excluded segment cannot be excised, it should at least be totally excluded as was accomplished by the second operation in the case reported.

Fig. 7.



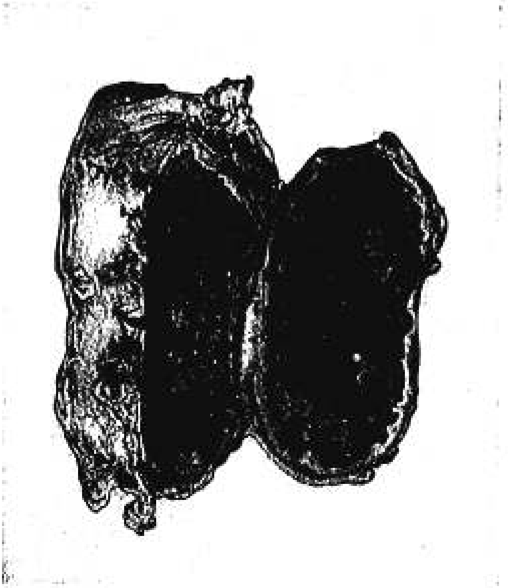
Bilateral or complete exclusion, with A, total occlusion B, dista. occlusion; C, proxima occlusion and D, both ends open and attached to skin.

The objectionable features of such operations also apply to the ordinary lateral anastomosis performed to shunt the intestinal contents by a diseased segment of gut. In such cases, if the obstruction is complete, accumulation occurs in that portion of the excluded loop which is proximal to the obstruction (Fig. 5). This objection has been recognized for a long time although its dangers have not been fully appreciated. In cases of fistula or when, for any reason, the presence of feces in the excluded loop is objectionable, lateral anastomosis is a complete failure inasmuch as the feces are not prevented from passing into it. For these reasons the end to side anastomosis resulting in a unilateral exclusion as recommended by Senn, is preferable (Fig. 6). Even when this operation is performed, fecal matter gathers to a certain extent, in the excluded segment on account of the double direction of the peristaltic movements in the large intestine, and if this is undesirable, complete exclusion as recommended by Salzer, should be performed; at least one end, preferably the distal, of the excluded loop being united to the skin (Fig. 7).

Unless one or both ends of a completely excluded loop communicate with the skin, or a communication exists by means of a fistula, troublesome accumulation is apt to occur. According to Reichel (Centralblatt f. Chirurgie, Bd. 22, S. 37) in experiments on animals, accumulation may or may not occur. Obalinski states (Centralblatt f. Chirurgie, Bd. 22, S. 129) that complete exclusion with total occlusion of the large intestine is safe but of the small intestine is dangerous on account of the preponderance of the secretory over the absorptive functions of the latter. According to Wiessinger (Deutsche Zeitschrift f. Chirurgie, Br. 62, S. 1) only one of four cases of complete exclusion with total occlusion was successful up to 1901, either rupture occurring with fistulous formation or death.

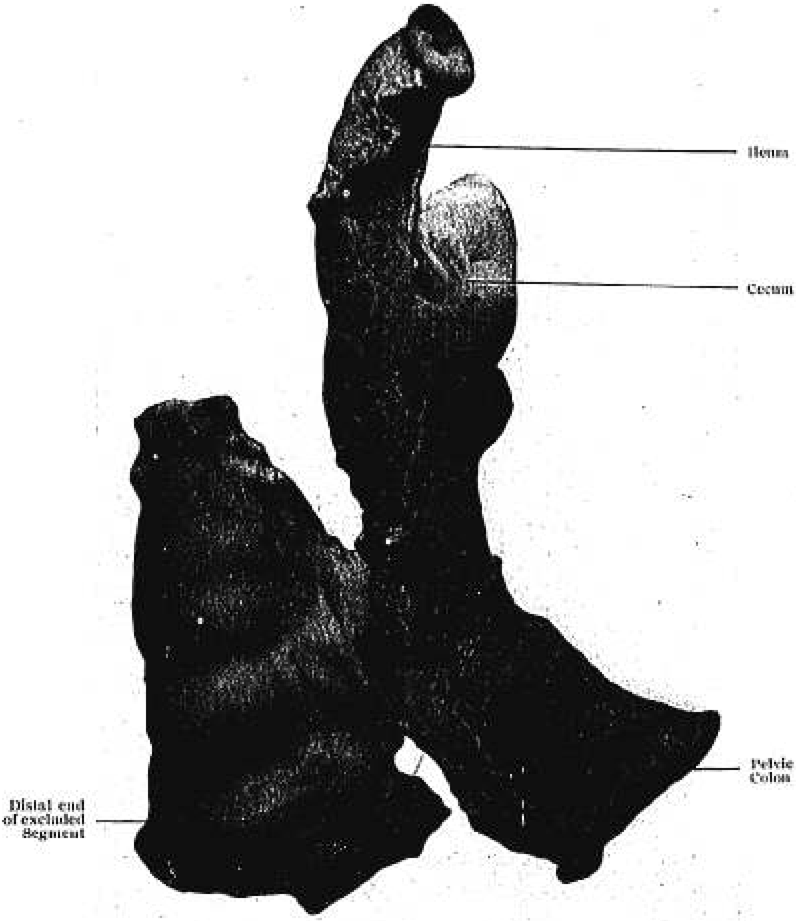
In order to determine the safety of complete exclusion combined with total occlusion of the large intestine, a series of five experiments were made on dogs. Two of the animals died of peritonitis immediately following the operation and the identity of one was lost leaving only two in which the result could be observed. One of these was killed four weeks

FIG. 8.



Photograph ⅔ natural size of completely excluded and occluded large intestine.

FIG. 9.



after the operation and the excluded segment was found to be distended with what was apparently fecal matter, to three times its normal diameter (Fig. 8). On section the walls were hypertrophic rather than thinned. The other animal was killed three weeks after operation and the result is well shown in Fig. 9. The photograph was taken one-half hour after the removal of the specimen and shows peristaltic contractions still taking place in the excluded segment. It is also interesting to note that the distal end is more distended than the proximal as a result of the peristalsis. The result of these experiments indicates that total occlusion, even of the large intestine is dangerous on account of distension of the segment by the excretions of the intestine. They also indicate that distal occlusion has the same effect upon the excluded loop as any obstruction has upon the intestine in general, namely, in increasing peristalsis and causing hypertrophy of the muscularis.

During the coming Winter further investigations will be carried out to ascertain the morphological and chemical nature of the semi-solid matter found in the excluded intestine. Its rapid accumulation is confirmatory of the theory that at least a large portion of the feces is excreted by the intestinal mucosa and that the function of the large intestine is not entirely absorptive.